

# ROBOT CONSTRUCTION SPECIFICATIONS

Build a rules-compliant robot · Plastic only · 2S / 3S battery limits

TOWNSVILLE · QUEENSLAND · AUSTRALIA

Based on SPARC Robot Construction Specifications v1.6 (21 September 2025) — [sparc.tools](#) · Club-specific rules are highlighted orange.

## 1. Overview and Purpose

**1.1.** This document sets out how to build a robot that will pass safety inspection and be eligible to compete at Townsville Robot Combat events. It is based on the SPARC Robot Construction Specifications v1.6, with club-specific rules highlighted orange. How matches are run is covered in the **Combat Robot Rules**, and how decisions are scored in the **Judging Criteria** (separate documents).

**1.2.** All participants build and operate robots at their own risk. Combat robotics is inherently dangerous. There is no amount of regulation that can encompass all the dangers involved. Please take care to not hurt yourself or others when building, testing and competing.

**1.3.** If you have a robot or weapon design that does not fit within the categories set out in these rules, or is in some way ambiguous or borderline, please contact the event organizer. Safe innovation is always encouraged, but surprising the event staff with your brilliant exploitation of a loophole may cause your robot to be disqualified before it ever competes.

## 2. Townsville Robot Combat Deviations from SPARC

Per SPARC section 2, event-specific changes from the baseline specification are summarised here and highlighted orange throughout this document:

**2.1. Plastic only.** All classes currently offered — AUS Antweight, US Antweight and Beetleweight — are **plastic only**, run under the club's 90% plastic construction rules (section 5).

**2.2. Battery voltage limits.** Maximum **2S** lithium battery voltage for the AUS and US Antweight classes and maximum **3S** for the Beetleweight class (section 9.3).

**2.3. Weapon brackets.** For the first competition, the AUS and US Antweight classes are split into Destructive and Non-destructive brackets (see the Combat Robot Rules, section 2.3).

**2.4. Internal combustion engines and liquid fuels are NOT allowed** (section 12), consistent with the SPARC default.

**2.5. Special weapons:** tethered projectiles ARE allowed; small smoke effects are allowed with prior approval; heat and fire are NOT allowed (section 16).

## 3. Cardinal Safety Rules

**3.1.** Compliance with all event rules is mandatory, and each event has safety inspections — it is at their sole discretion that your robot is allowed to compete. As a builder you are obligated to disclose all operating principles and potential dangers to the inspection staff.

**3.2.** Failure to comply with any of the following cardinal safety rules could result in expulsion or worse, injury and death:

**3.2.1.** Radios that do not operate using spread spectrum technology may not be turned on at or near events for any purpose without obtaining the appropriate frequency clip or explicit permission from the event.

**3.2.2.** Proper activation and deactivation of robots is critical. Robots must only be activated in the arena, testing areas, or with expressed consent of the event and its safety officials.

**3.2.3.** All robots must be able to be FULLY deactivated, which includes power to drive and weaponry, in under 60 seconds by a manual disconnect.

**3.2.4.** All robots not in an arena or official testing area must be raised or blocked up in a manner so that their wheels or legs cannot cause movement if the robot were turned on. Runaway bots are VERY dangerous.

**3.2.5. Locking devices:** moving weapons that can cause damage or injury must have a clearly visible locking device in place at all times when not in the arena. Locking devices must be clearly identified — acceptable options include neon paint, brightly coloured tabs, and remove-before-flight tags. Locking devices must be clearly capable of stopping, arresting or otherwise preventing harmful motion of the weapon, and must securely affix in place on the robot such that they cannot easily come loose or fall off without intent.

**3.2.6.** Weapon locking pins must be in place when weapon power is applied during a robot's power-on procedure. This includes all powered weapons regardless of the power source or weight class.

**3.2.7.** It is expected that all builders will follow basic safety practices during work on the robot at your pit station. Please be alert and aware of your pit neighbours and people passing by.

## 4. Weight Classes

**4.1.** This event offers the following weight classes. Weights follow the international standard.

Class	Name	Weight	Division
Class 01	(AUS) Antweight	150 g	Plastic only · Destructive & Non-destructive brackets
Class 02	(US) Antweight	454 g (1 lb)	Plastic only · Destructive & Non-destructive brackets
Class 03	Beetleweight	1.36 kg (3 lb)	Plastic only

Other weight class robots may be permitted to operate as an exhibition-class demonstration only — at the discretion of the event operator based on arena safety — but no organised competition or prizes will be offered for classes other than those listed. Higher weight classes — including the 2.72 kg (6 lb) Mantisweight class — will be added to the competition at later events, and these documents will be revised when they are.

**4.2. Locomotion weight bonuses.** Shufflers receive a 1.25× weight bonus; non-traditional locomotion receives a 1.5× bonus; walkers receive a 2× bonus. Applied to this event's classes:

Class	Rolling	Shuffler (1.25×)	Non-traditional (1.5×)	Walker (2×)
(AUS) Antweight	150 g	187.5 g	225 g	300 g
(US) Antweight	454 g (1 lb)	567 g (1.25 lb)	680 g (1.5 lb)	907 g (2 lb)
Beetleweight	1.36 kg (3 lb)	1.70 kg (3.75 lb)	2.04 kg (4.5 lb)	2.72 kg (6 lb)

Robots are classified as walkers, shufflers or non-traditional at the sole discretion of the Event Organizer per the definitions in section 6, and classifications are not subject to appeal. Contact the Event Organizer if in doubt.

## 5. 90% Plastic Construction Rules

**5.1.** Robots entered in a 90% Plastic division must be built to a minimum of 90% plastic, leaving a maximum of 10% of the robot to be made from materials other than plastic. The 90% plastic rule keeps bots affordable, safer in the arena and accessible to newcomers.

**5.2.** The up-to-10% other-material allowance must be used for securing and small parts only — for example fasteners, axles, bearings and similar hardware. The one exception is the weapon: you may instead choose to use your other-material allowance on the weapon.

**5.3.** The up-to-10% other-material allowance must not be used to reinforce plastic pieces — not across the face of a plastic piece, and not inside or running through the body.

**5.4.** Note: SPARC v1.6 also defines an official “Plastic Class” (SPARC section 16.3) restricted to FDM-printed PLA/PLA+/PET/PETG/ABS/ASA. Townsville Robot Combat uses the club’s 90% plastic rule above rather than the SPARC Plastic Class specification.

## 6. Mobility

**6.1.** All robots must have easily visible and controlled mobility in order to compete. Methods of mobility include but are not limited to:

**6.1.1. Rolling** (wheels, tracks or the whole robot).

**6.1.2. Walking:** walking robots have no rolling elements in contact with the floor and no continuous rolling or cam-operated motion in contact with the floor, either directly or via a linkage. Motion is “continuous” if continuous operation of the drive motor(s) produces continuous motion of the robot. Linear-actuated legs and novel non-wheeled drive systems may qualify for the walker bonus. If you intend to enter a non-wheeled robot, contact the event as soon as possible to determine what weight bonus, if any, you qualify for.

**6.1.3. Shuffling** (rotational cam-operated legs).

**6.1.4. Non-traditional:** bristle/torque drive (vibration or torque reaction of a powered system generating motion); gyro walkers (gyroscopic forces with a rotating arm tilting a portion of the robot); and ground-effect air cushions (hovercraft).

**6.1.5. Jumping and hopping** may be allowed — contact the event organizer if you intend to use this as a method of locomotion.

**6.1.6. Flying** (airfoil-using, helium balloons, ornithopters, etc.) may be allowed at some events — contact the event organizer if you intend to use this as a method of locomotion.

## 7. Robot Control Requirements

**7.1.** Tele-operated robots must be radio controlled, or use an approved custom system as described in 7.4.3. Radio controlled robots must use approved ground frequencies — 2.4 GHz digital spread-spectrum systems are the standard in Australia and strongly recommended.

**7.2.** Tethered control is not allowed.

**7.3.** Pre-1991 non-narrow-band radio systems are not allowed.

**7.4.** Radio system restrictions:

**7.4.1.** Radio systems that stop all motion in the robot (drive and weapons) when the transmitter loses power or signal are required for all robots with active weapons. This may be inherent in the robot’s electrical system or be part of programmed fail-safes in the radio. Robots 1 lb and under will typically be required to have drive fail-safes.

**7.4.2.** All robot radio systems must have a way to change frequencies or coded channels to prevent radio conflicts. Having at least two frequencies or coded channels available is required. Digital spread-spectrum radios that use frequency hopping or automatic channel selection qualify under this rule.

**7.4.3.** If you are using a home-built control system, or a control system not covered here, you must first clear it with the event.

**7.5.** This event does not require a separate power switch for the radio.

## 8. Autonomous / Semi-Autonomous Robots

**8.1.** Any robot that moves, seeks a target, or activates weapons without human control is considered autonomous. If your robot is autonomous you are required to contact this event before registration.

**8.2.** Autonomous robots must have a clearly visible light for each autonomous subsystem that indicates whether or not it is in autonomous mode — e.g. if your robot has two autonomous weapons it should have two “autonomous mode” lights (separate from any power or radio indicator lights).

**8.3.** Robots in the 12 lb (5.44 kg) or under classes — which includes every class offered at this event — are exempt from the remaining autonomous rules in SPARC section 7, but safe operation, arming, and disarming must be demonstrated in safety inspections.

## 9. Batteries and Power

**9.1.** The only permitted batteries are ones that cannot spill or spray any of their contents when damaged or inverted. Standard automotive and motorcycle wet-cell batteries are prohibited. Examples of permitted batteries: gel cells, Hawkers, NiCads, NiMh, dry cells, AGM, Li-Ion, LiFe, LiPoly, etc. If your design uses a new type of battery, or one you are not sure about, please contact the event.

**9.2.** All onboard voltages above 48 volts require prior approval from this event. (It is understood that a charged battery's initial voltage state is above its nominal rated value.)

**9.3. Battery voltage limits by class.** The maximum battery voltage powering the combat robot is limited per class: the **AUS Antweight (150 g)** and **US Antweight (454 g / 1 lb)** classes are limited to a maximum of **2S lithium (7.4 V nominal / 8.4 V fully charged)**, and the **Beetleweight (1.36 kg / 3 lb)** class is limited to a maximum of **3S lithium (11.1 V nominal / 12.6 V fully charged)**. Equivalent voltage limits apply to non-lithium chemistries. Robots exceeding these limits will not pass the safety inspection for this event.

**9.4.** All electrical power to weapons and drive systems (systems that could cause potential human bodily injury) must have a manual disconnect that can be activated within 15 seconds without endangering the person turning it off (e.g. no body parts in the way of weapons or pinch points). Shutdown must include a manually operated mechanical method of disconnecting the main battery power, such as a switch (Hella, Whyachi, etc.) or removable link. Relays may be used to control power, but there must also be a mechanical disconnect. Complete shut-down time is specified in section 3.2.3.

**9.5.** All efforts must be made to protect battery terminals from a direct short and causing a battery fire.

**9.6.** If your robot uses a grounded chassis you must have a switch capable of disconnecting this ground.

**9.7.** All robots must have a light easily visible from the outside of the robot that shows its main power is activated.

## 10. Pneumatics

**10.1.** Pneumatic systems on board the robot must only employ non-flammable, non-reactive gases (CO<sub>2</sub>, nitrogen and air are most common). It is not permissible to use fibre-wound pressure vessels with liquefied gases like CO<sub>2</sub> due to extreme temperature cycling.

**10.2.** You must have a safe and secure method of refilling your pneumatic system. SPARC recommends standard paintball fill fittings.

**10.3. Exemption for this event's classes:** robots 12 lb (5.44 kg) and under — which includes every class offered at this event — and systems with gas storage of 2 fl oz or less are exempt from the remaining SPARC pneumatic rules, provided the maximum actuation pressure is **250 psi or less** and all components are used within the

specifications provided by the manufacturer or supplier. If specifications aren't available or reliable, it is up to the Event Organizer to decide whether the component is being used in a sufficiently safe manner.

**10.4.** All pneumatic components on board must be securely mounted, with particular attention to pressure vessel mounting and armour to ensure a ruptured vessel cannot escape the robot. Components must be rated for at least the maximum pressure in their part of the system, and you may be required to show rating or certification documentation for any component.

**10.5.** Pneumatic systems with pressures below 100 psi, small volumes (12–16 g CO2 cartridges), single-firing applications, or pneumatics used for internal actuation (as opposed to external weaponry) may also be exempted. You are required to contact this event if you would like an exception.

## 11. Hydraulics

**11.1.** Robots in the 12 lb (5.44 kg) class or lighter — which includes every class offered at this event — are exempt from the remaining SPARC hydraulic rules, but good engineering and best practices must be used in all hydraulic systems. The pressure for 12 lb or lighter robots is limited to **250 psi** and there must be an easy way to determine this pressure. Contact the event with any questions.

**11.2.** All hydraulic systems must use non-flammable, non-corrosive fluid and must be designed not to leak when inverted.

## 12. Internal Combustion Engines (ICE) and Liquid Fuels

**12.1. Internal combustion engines and liquid fuels are NOT allowed** at Townsville Robot Combat events (consistent with the SPARC v1.6 default). This may change for later events as we upgrade the arena and familiarise ourselves with the fire and unique hazards that ICE engines present — any change will be announced and the applicable SPARC section 11 rules adopted at that time.

## 13. Rotational Weapons and Full-Body Spinning Robots

**13.1.** Spinning weapons that can contact the outer arena walls during normal operation must be pre-approved by the event. (Contact with an inner arena curb or containment wall is allowed and does not require prior permission.)

**13.2.** Spinning weapons must come to a full stop within 60 seconds of the power being removed, using a self-contained braking system.

## 14. Springs and Flywheels

**14.1.** Springs used in robots in the 12 lb class or smaller — every class offered at this event — and those loaded simply by the weight of the robot (e.g. suspension systems) are excepted from the remaining SPARC spring rules. However, safe operation and good engineering are always required.

**14.2.** Any flywheel or similar kinetic-energy-storing device must not be spinning or storing energy in any way unless inside the arena or testing area, and there must be a way of generating and dissipating the energy from the device remotely under the robot's power.

**14.3.** All springs, flywheels, and similar kinetic-energy-storing devices must fail to a safe position on loss of radio contact or power.

## 15. Forbidden Weapons and Materials

The following weapons and materials are absolutely forbidden from use:

**15.1.** Weapons designed to cause invisible damage to the other robot, including but not limited to:

**15.1.1.** Electrical weapons.

**15.1.2.** RF jamming equipment, etc.

**15.1.3.** RF noise generated by an IC engine.

**15.1.4.** EMF fields from permanent or electro-magnets that affect another robot's electronics.

**15.1.5. Entangling weapons or defenses:** weapons or defenses that can reasonably be expected to stop drive train and/or weapon motion by being wrapped around rotating parts. This includes nets, tapes, strings, and other entangling materials or devices. (Note: under SPARC v1.6 entangling weapons are now absolutely forbidden, with no event opt-in.)

**15.1.6.** Weapons or defenses that can reasonably be expected to stop combat completely of both (or more) robots.

**15.2.** Weapons that require significant cleanup, or in some way damage the arena to require repair for further matches, including: liquid weapons (additionally, a bot may not have liquid that can spill out when superficially damaged); foams and liquefied gases; and powders, sand, ball bearings and other dry chaff weapons.

**15.3.** Un-tethered projectiles (see tethered projectile rules in section 16.1).

**15.4.** Heat and fire are forbidden as weapons. This includes, but is not limited to: heat or fire weapons not specifically allowed in section 16.2; flammable liquids or gases; and explosives or flammable solids such as DOT Class C devices, gunpowder / cartridge primers, and military explosives.

**15.5.** Light- and smoke-based weapons that impair the viewing of robots by an entrant, judge, official or viewer. (You are allowed to physically engulf your opponent with your robot, however.) This includes smoke weapons not specifically allowed in section 16.3, and lights such as external lasers above Class I and bright strobe lights which may blind the opponent.

**15.6.** Hazardous or dangerous materials are forbidden from use anywhere on a robot where they may contact humans, directly or by way of the robot being damaged (within reason). Contact the event if you have a question.

## 16. Special Weapons at This Event

**16.1. Tethered projectiles ARE allowed at this event** (a deviation from the SPARC v1.6 default). Tethered projectiles must have a securely attached tether or restraining device of sufficient strength to safely stop the projectile at a distance of no more than 8 feet (2.4 m) from the robot.

**16.2. Heat and fire are NOT allowed at this event** (the SPARC default).

**16.3. Small smoke effects are allowed at this event** with prior approval — contact the event if you plan on using them.